MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

EEE3096 – COMMUNICATION ELECTRONICS
(TE)

14 OCTOBER 2019
2.30 P.M. – 4.30 P.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages with 4 Questions only.
2. Attempt **ALL FOUR** questions.
3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) The procedure of measuring gain of an amplifier at radio frequency (RF) using attenuator are illustrated below (Figure Q1a) :

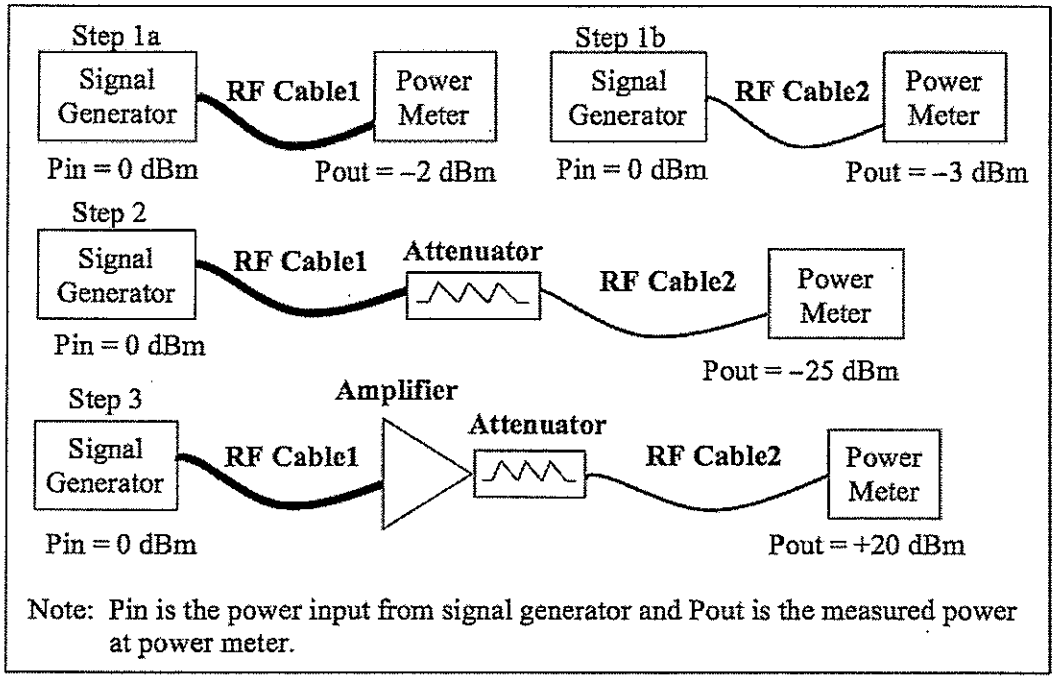

Figure Q1a

(i) Briefly explain THREE (3) usages of attenuator in a typical RF application.

[6 marks]

(ii) What are the power losses contributed by the RF cable1 and RF cable2?

[2 marks]

(iii) Determine the loss contributed by the attenuator.

[2 marks]

(iv) Determine the gain of the amplifier.

[2 marks]

(b) A cascaded attenuator shown in Figure Q1b is used to reduce the source voltage to load R_L. It is required that the image impedance looking into the input of the attenuator be equal to the load resistor, such as $Z_i = R_L$.

(i) For each stage, determine the attenuation factor (in dB). What is the total attenuation factor (in dB) for this cascaded system?

[4 marks]

(ii) Calculate the values of R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8 and R_9.

[9 marks]

Continued .....

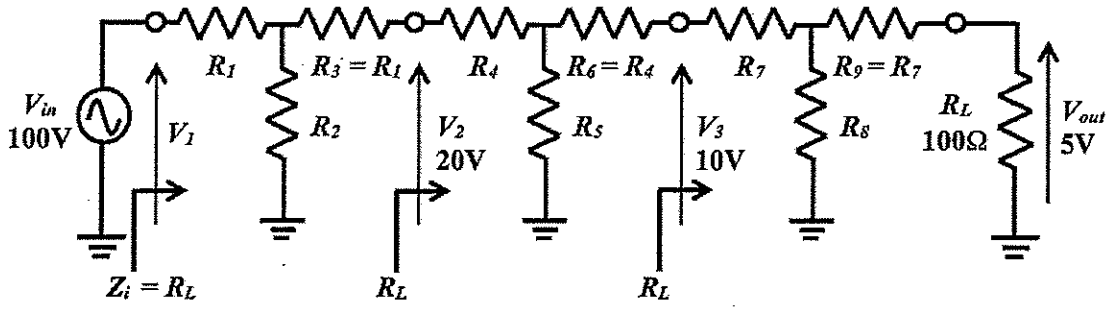

Figure Q1b

Question 2

Figure Q2a and Q2b show the schematic circuit diagrams of a typical Class A Common-Emitter (CE) amplifiers at 100 MHz with V_{BE} = 0.7 V and current gain, β = 50.

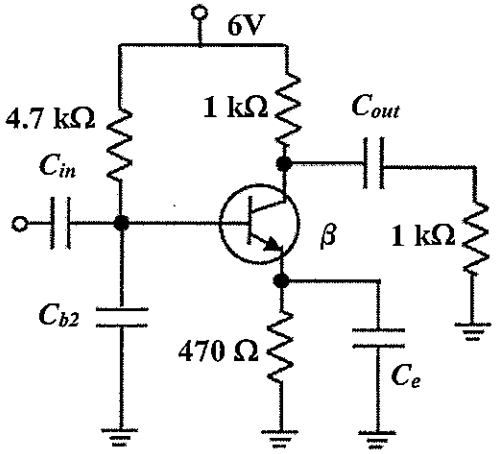

Figure Q2a

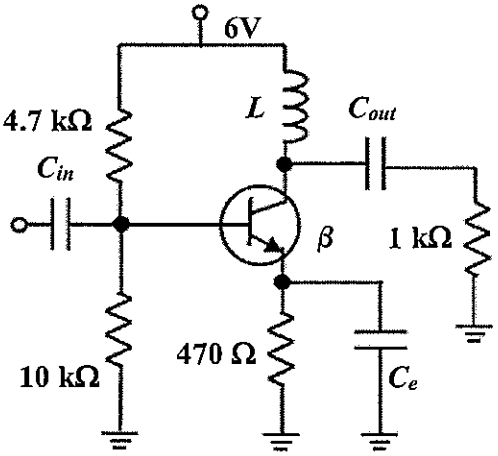

Figure Q2b

(i) Explain briefly a simple CE amplifier design flow.

[4 marks]

(ii) Describe briefly the function of capacitors, C_{in}, C_{out} and C_e. Also, suggest suitable values for these capacitors.

[3 marks]

(iii) Name the biasing techniques and state their respective ONE (1) advantage for each circuit.

[4 marks]

(iv) Draw the DC equivalent circuits and perform DC analyses to determine the DC collector current I_C on both circuits.

[8 marks]

Continued .....

(v) Determine the gain of both amplifiers at low and high frequencies. Assume that the internal volt drop across the Emitter junction layer is approximately 25 mV.

[6 marks]

Question 3

Two frequency synthesizers shown in Figure Q3a are used to up-convert an Intermediate Frequency (f_{IF}) of 100 MHz to a 2 GHz RF signal (f_{RF}) in a transmitter with mixers and band pass filters (center frequency, f_c). The crystal oscillator frequency (f_{ox}) is 100 MHz.

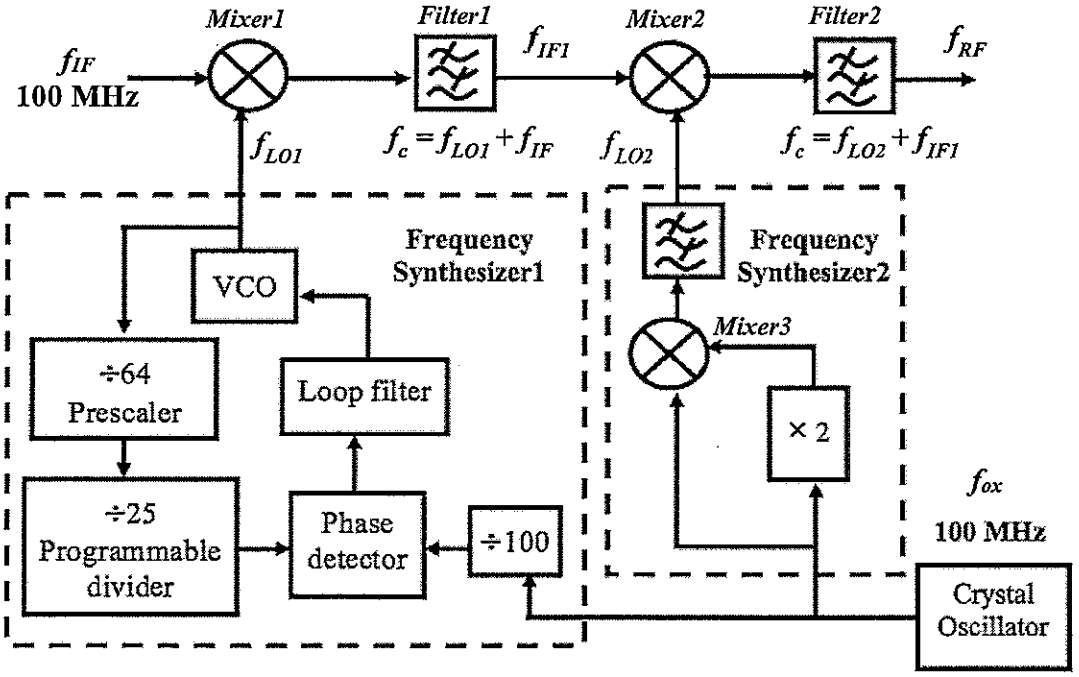

Figure Q3a

(i) Define the "frequency synthesizer" in communication electronics. State THREE (3) key performance parameters to be considered in selecting a frequency synthesizer.

[4 marks]

(ii) Describe briefly the synthesis method used in the "Frequency Synthesizer1" (f_{LO1}). State ONE (1) advantage and ONE (1) disadvantage of using this method.

[3 marks]

(iii) Describe briefly the synthesis method used in the "Frequency Synthesizer2" (f_{LO2}). State ONE (1) advantage and ONE (1) disadvantage of using this method.

[3 marks]

Continued .....

(iv) Determine the frequencies of the local oscillators, f_{LO1} and f_{LO2}.

[4 marks]

(v) List the frequencies appear after the first mixer (Mixer1) in this transmitter.

[4 marks]

(vi) List the frequencies appear after the second mixer (Mixer2) in this transmitter.

[4 marks]

(vii) Determine the resolution of the "Frequency Synthesizer1" (f_{LO1}) (the minimum difference in frequency between two adjacent channels).

[3 marks]

Question 4

Figure Q4a shows the analog monochrome television (TV) signal transmission using Vestigial Sideband (VSB) modulation. A double sideband (DSB) modulated signal (A) with carrier frequency of 11 MHz and another single sideband (SSB) signal (B) with carrier frequency of 16.75 MHz are filtered and then up-converted into new carrier frequencies (f_{CA} and f_{CB}) by a local oscillator before they are broadcasted into the Very High Frequency (VHF) range.

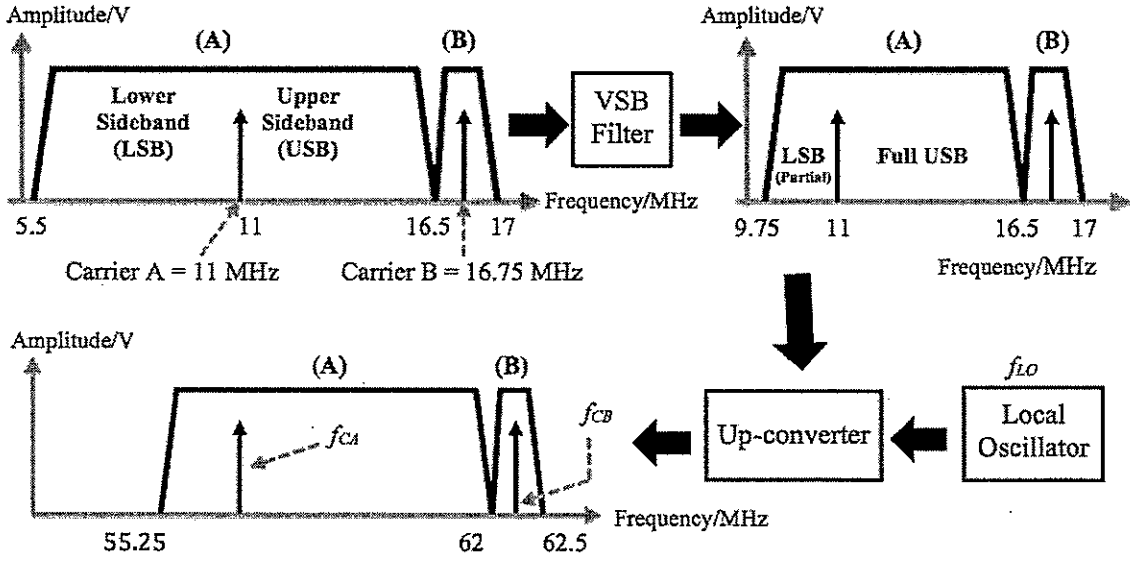

Figure Q4a

(i) State THREE (3) advantages and TWO (2) disadvantages of VSB modulation in analog monochrome television transmission.

[5 marks]

(ii) Determine the bandwidth of the signal before and after the VSB filtering. How much is the bandwidth saving after applying the VSB filter?

[3 marks]

Continued .....

(iii) What types of information and modulation are transmitted in the spectrum A and B?

[2 marks]

(iv) Determine the required local oscillator frequency (f_{LO}) and the new carrier frequencies (f_{CA} and f_{CB}) after the up-conversion.

[3 marks]

(v) A super-heterodyne television receiver with fixed local oscillator frequency of 66.5 MHz is tuned to the above signal. Determine and draw the spectrum of the received IF signal at the receiver if high side injection is used. Determine its respective range of image frequencies.

[5 marks]

(vi) Determine the respective range of image frequencies if low side injection is used in the receiver in part (v).

[4 marks]

(vii) For high quality digital TV transmission in the United States, 8-level VSB modulation is usually deployed in the transmitter. Describe briefly the working principles of 8-level VSB modulation. State ONE (1) advantage and ONE (1) disadvantage of 8-level VSB in digital TV transmission.

[3 marks]

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